

WHAT IS CLAIMED IS:

1. A swallowable data recorder medical device comprising:
a capsule including:
5 a sensing module for sensing a biologic condition within a body;
a recording module including an atomic resolution storage device, the
recording module electrically coupled to the sensing module for
recording data representative of the sensed biological condition,
in the atomic resolution storage device; and
10 a power supply coupled to the recording module.
2. The device of claim 1, wherein the sensing module provides an output
signal representative of the sensed biological condition, and the recording
module includes a controller for receiving the output signal from the sensing
15 module.
3. The device of claim 2, wherein the controller performs one or more
logical operations using the output signal, and selectively provides output data to
the atomic resolution storage device based upon the logical operations.
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4. The device of claim 1, wherein the recording module includes
programmable logic.
5. The device of claim 4, wherein the programmable logic is located on the
25 atomic resolution storage device.
6. The device of claim 1, wherein the atomic resolution storage device
further comprises:
a field emitter fabricated by semiconductor microfabrication techniques
30 capable of generating an electron beam current; and

a storage medium in proximity to the field emitter and having a storage area in one of a plurality of states to represent the information stored in the storage area.

- 5 7. The device of claim 6, wherein an effect is generated when the electron beam current bombards the storage area, wherein the magnitude of the effect depends upon the state of the storage area, and wherein the information stored in a storage area is read by measuring the magnitude of the effect.
- 10 8. The device of claim 6, further comprising:
a plurality of storage areas on the storage medium, with each storage area being similar to the one recited in claim 6; and
a microfabricated mover in the storage device to position different storage areas to be bombarded by the electron beam current.
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9. The device of claim 8; further comprising:
a plurality of field emitters, with each emitter being similar to the one recited in claim 6, the plurality of field emitters being spaced apart, with each emitter being responsible for a number of storage areas on the storage medium; and
20 such that a plurality of the field emitters can work in parallel to increase the data rate of the storage device.
- 25 10. The device of claim 1, wherein the sensing module includes an image detector.
11. The device of claim 1, wherein the sensing module includes a chemical detector.
- 30 12. The device of claim 1, wherein the sensing module includes a plurality of chemical detectors.

13. The device of claim 1, wherein the sensing module includes an electrical detector.
14. The device of claim 1, wherein the recording module is made from a
5 silicon material.
15. The device of claim 1, wherein the sensing module and recording module are disposed on a silicon chip.
- 10 16. The device of claim 1, wherein an outer surface of the capsule is made of an inert material.
17. The device of claim 16, wherein the inert material is at least one of a glass material, a ceramic material, and a polymer material.
- 15 18. The device of claim 1, wherein the sensing module includes a multidirectional image sensor.
19. The recorder of claim 18, wherein the multidirectional image sensor
20 comprises at least six image sensors arranged substantially perpendicular to one another along six cardinal directions.
20. The device of claim 1, further comprising a magnetic member, wherein the magnetic member permits manipulation of the capsule from a non-body
25 location.
21. A swallowable data recorder medical device comprising:
a capsule including:
a sensing module for sensing a biologic condition within a body, the
30 sensing module including a video receiver, wherein sensing the biologic condition includes the video receiver receiving video of the biologic condition;

- a recording module including an atomic resolution storage device, the
recording module electrically coupled to the sensing module for
recording data representative of the sensed biological condition,
in the atomic resolution storage device; and
5 a power supply coupled to the recording module.
22. The device of claim 21, wherein the sensing module further includes an
illumination source.
- 10 23. A method of recording data internally within a human body comprising:
ingesting an inert capsule within a digestive tract of a human body;
sensing a predetermined type of biological condition within the digestive
tract with a sensor disposed within the capsule; and
recording the sensed biologic condition as data in an atomic resolution
15 storage device memory module within the capsule while the
capsule is in the digestive tract.
24. The method of claim 23, further comprising:
retrieving the sensed data from memory module when the capsule is
20 outside of the human body.
25. The method of claim 24, wherein the retrieving step further comprises
the step of:
capturing the capsule after passage of the capsule through the digestive
25 tract.
26. The method of claim 23, further comprising the step of:
transmitting the data from the capsule to a location outside of the human
body while the capsule is within the human body.
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27. The method of claim 23, wherein the sensing step further comprises the
step of:

obtaining an image of a predetermined body location within the digestive tract.

- 5 28. The method of claim 24, wherein the obtaining step further comprises:
arranging a magnetic member in the capsule prior to the ingesting step;
arranging a magnet positioner outside the body; and
magnetically manipulating the relative position and orientation of the
capsule within the digestive tract by using the magnet positioner
to move the magnetic member in the capsule.
- 10 29. The method of claim 23, wherein the sensing step further comprises the
step of:
exposing a chemical sensor array on the surface of the capsule to sense
one or more chemical conditions in the digestive tract.
- 15 30. The method of claim 29, wherein the exposing step further comprises the
step of:
sensing at least one of a relative amount and an absolute amount of at
least one or more digestive tract constituents.
- 20 31. The method of claim 30, wherein the sensing step further comprises the
step of:
sensing a pH of the digestive tract constituents.
- 25 32. The method of claim 23, wherein the sensing step further comprises the
step of:
exposing an electrically based sensor in the capsule to sense biologic
conditions.
- 30 33. The method of claim 32, wherein the exposing step further comprises the
step of:
sensing a temperature within the digestive tract.

34. The method of claim 23, further comprising the step of:
performing the sensing step at a predetermined body location within the
digestive tract that corresponds to a known location for the
predetermined biologic condition.
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35. The method of claim 34, further comprising the step of:
identifying the passage of the capsule at a predetermined body location
within the digestive tract using at least one of a radiographic
technique and an ultrasonic technique.
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36. The method of claim 23, wherein the recording step further comprises the
step of:
recording sensed data continuously within the digestive tract.
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37. The method of claim 23, wherein the recording step further comprises the
step of:
initiating and maintaining recording of the sensed data when the sensed
data reaches a predetermined value of a predetermined biologic
condition.
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